LLNL Environmental Restoration Division Standard Operating Procedure	TITLE: Photovac Portable Gas Chromatograph Operating Instructions
APPROVAL Date _____ _____ Environmental Chemistry and Biology Group Leader	PREPARER: R. Caufield REVIEWERS: T. Carlsen, P. Daley, V. Dibley, and J. Greci,
APPROVAL Date _____ _____ Division Leader CONCURRENCE Date _____ _____ QA Implementation Coordinator	PROCEDURE NUMBER: ERD SOP-4.10 REVISION: 0 EFFECTIVE DATE: September 1, 1995 Page 1 of 19

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes procedures for the operation and maintenance of the Photovac 10S70 portable gas chromatograph. This SOP also provides instrument set-up parameters that can be applied in several types of direct injection gas and vapor analyses, including BETX and solvents. In addition, this SOP outlines an operational framework to guide the novice in the use of the Photovac.

2.0 APPLICABILITY

The procedures described in this SOP are applicable to Photovac operation in a direct injection mode. Analytical possibilities include soil vapor testing, headspace analyses, ambient air monitoring, and quantification of any compound in gaseous or vapor form, which can be detected by a photoionization detector. The analyses can be conducted in a laboratory setting or at remote locations lacking electrical hook-ups. The Photovac can be used for on-the-spot sample screening since data is immediately produced.

3.0 REFERENCES

3.1 Photovac International Incorporated (November 1987), Photovac Operating Manual, Huntington NY.

4.0 DEFINITIONS

4.1 [ ]

Used to represent buttons on Photovac keypad; word within brackets identifies the specific button.

4.2 Aliquot

A representative portion of a larger sample that is removed for the purpose of analysis.

4.3 BETX

Acronym for: benzene, ethylbenzene, toluene, o-xylene, m-xylene, and p-xylene. These are common components of gasoline.

4.4 Calibration Standard

A chemical solution of known concentration used to identify and quantify substances within a sample matrix. Used interchangeably with standard.

4.5 Chromatogram

The plotted graphical results of an analysis run showing detected compounds as individual peaks.

4.6 Gain

A signal multiplying adjustment that effectively serves as a sensitivity setting. Low concentration samples require high gain settings.

4.7 Library

A memory block in the Photovac used by the operator to store calibration and set up parameter information. Four libraries are available.

4.8 Photoionization Detector (PID)

A portable field instrument used to quantify purgeable aromatic compounds such as benzene, toluene, and xylene in vapors, but is also useful for other hydrocarbons. It is most effective on unsaturated compounds containing double bonds. The PID works by directing UV light onto the molecules, ionizing them, and measuring the current generated. The measured current is directly proportional to the number of ionized molecules, so the concentration of the compound(s) can be determined. It is usually calibrated against isobutylene, but can be calibrated using a compound of interest such as trichloroethene (TCE). However, this devise is not compound specific and its measurements represent an aggregate concentration of all compounds that are ionized and

detected. Response factors can be changed to target specific compounds. This device is sensitive to moisture, therefore moist vapor streams should be analyzed using an alternate instrument such as an FID.

4.9 Photovac

Portable gas chromatograph manufactured by Photovac International, Inc.

4.10 Retention Time

The time duration for a chemical compound to reach the detector starting from the time the sample is injected into the instrument.

4.11 Standard

A chemical solution of known concentration used to identify and quantify substances within a sample matrix. Used interchangeably with calibration standard.

4.12 Zero Air

A grade rating of purified air used as carrier gas by the Photovac to move samples through the separation column to the detector. Carrier gas should be <0.1 ppm total hydrocarbons; higher purities allow lower detection limits.

5.0 RESPONSIBILITIES

5.1 Division Leader

The Division Leader's responsibility is to ensure that all activities performed by ERD at the Livermore Site and Site 300 are performed safely and comply with all pertinent regulations and procedures, and provide the necessary equipment and resources to accomplish the tasks described in this procedure.

5.2 Technician

Operates and maintains the instrument and equipment in accordance with this written procedure. Ensures the instrument and accessory equipment are in good working order before using for analyses. Ensures the produced chromatograms will provide the desired data. Completes the necessary information for the required Quality Assurance (QA) records and submits results to the document control center for storage and retrieval.

6.0 PROCEDURES

6.1 Discussion

Operation of the Photovac requires some familiarity with the principles of gas chromatography. A gas sample injected into the Photovac is separated into its constituent components as it travels through the capillary column. The time it takes for a compound to reach the detector will be the same under constant carrier gas flow rate and column temperature. This property allows identification of individual compounds. A key to good chromatography is to achieve complete separation of a sample's constituent compounds.

6.2 Start Up

6.2.1 Establish and check all instrument electrical, communication and gas connections:

A. AC power cord to a suitable 115 volt electrical outlet.

B. 12 volt AC to DC adapter to "ext DC" (for column oven operation).

C. Carrier gas supply tank regulator to "external carrier in".

D. Flow meters to the "detector out" and "aux out" ports.

E. Communication cable to "phone/serial" (if applicable).

6.2.2 Start up the instrument by following these steps in order:

A. Begin *zero air* carrier gas flow using an external or internal supply tank.

1. If an external tank source is being used, ensure the regulator is connected, then simply open the tank valve.

2. For operation at remote locations, the internal carrier-supply tank can be used. This tank must be filled to no more than 1,750 psi with zero air from an external source. Refer to the Photovac manual for the filling procedure.

3. The delivery pressure gauge on the Photovac should read 40 psi with either source.

B. Turn on the column internal oven and set temperature to the desired level.

1. The adjustment knob is located on the oven casing within the Photovac housing. The oven is normally set at 30°C or 40°C depending on the specific analysis. Use a lower temperature if better separation is necessary and higher settings if reduced analysis time is desired.

C. Power up instrument by hitting the [on] key. Important: Never turn on the instrument without first establishing carrier gas flow or column damage may occur.

2. Display should read "ready enter command" within a couple minutes. If display continues to read "lamp not ready please wait", detector adjustment may be necessary. (Consult Photovac manual for adjustment procedure).

D. Allow a 30 minute warm-up period before performing analyses. However, information for set up, calibrations, etc., may be entered and edited during this time.

E. Set the date and time by hitting [use] [enter] and following the displayed steps. Input changes as necessary.

F. Check carrier gas flow rates *after* the initial warm-up period.

1. The desired flow rate will depend on the specific analytical situation. For most situations, a flow measure of 10 units works well. Consult the flow meter conversion chart to convert unit values to mL gas per minute.

2. The “detector out” and “aux out” flow rates should be equal and should stay constant in both the stand-by and run modes. Monitor the flow rates throughout the analysis period and readjust if necessary. Refer to the Photovac operation manual for the flow adjustment procedure.

G. After steps 1–6 have been completed, the Photovac is ready for calibration.

6.3 Set Up

The following set-up parameters are recommended for most analyses and are normally maintained within the Photovac’s memory. However, the parameters should always be verified after instrument start up. To check, hit the appropriate key then move through the displayed steps using the [enter] key. The settings may be modified as necessary for the specific analytical situation. Note: each library stores a separate parameter set.

Parameters	Setting
Offset	**0.0**
Chart speed	**0.5 cm/min**
Slope sensitivity up	**16**
Slope sensitivity down	**16**
Peak width	**4**
Window	**5%**
Minimum area	**100 mVs**
Timer delay	**10 seconds**
Analysis time	**1,000 seconds**
Cycle time	**0.0 seconds**

Event #	On time	Off time
1	**8.0**	**10.0**
3	**10.0**	**150.0**
All others	**0.0**	**0.0**

6.4 Calibration

Calibration is performed by injecting a vapor or gas standard of a known concentration and measuring the detector response. Standards can either be prepared on site from stock chemicals or certified calibration gases can be obtained from commercial sources. Choice of standard depends on specific analytical requirements and desired level of accuracy.

6.4.1 Instrument calibration procedure is as follows:

A. Clear existing calibration set from libraries to be used:

1. List library: [list] library # [enter].
2. Edit contents: [edit] compound ID # [enter] [clear] [enter].

3. Repeat step (b) for each compound.
4. Repeat steps (a), (b), (c) for next library.

B. Relist libraries to ensure all previously stored compounds have been cleared.

C. Ensure calibration standard container is at ambient temperature. Warm if necessary.

D. Using a syringe, obtain the desired volume of standard through the septum port on the calibration gas container. If using a canister with a pressure regulator, dead space should be purged with calibrant gas to assure a representative aliquot is obtained.

E. Inject the calibration standard into the Photovac through injection port #1. The injection procedure is described in detail in Section 6.5, "Sample Analysis."

6.4.2 A single point or a multiple point calibration procedure can be used to determine sample concentrations. Choice of method will depend on time constraints and level of accuracy desired.

A. Single point calibration

1. The gas standard concentration selected should be within the expected range of sample concentrations. Sample injection volumes can be varied to obtain detector signal responses near that of the calibration standard.
2. After the calibration run is complete, detector response for each compound will be printed out in volt-seconds or millivolt-seconds. The respective ppm values can be stored into a library using the following procedure:

   a. [Use] desired library # [enter].
   b. Skip through date and time setting by hitting [enter] several times.
   c. [Store] peak # [enter].
   d. Compound name [enter].
   e. Compound concentration [enter].
   f. [Enter].
   g. Repeat these steps for each compound. Repeating Steps A. and B. may not be necessary, since the Photovac will remain in a library until changed by the user).
   h. Check entries when finished by hitting [cal] [enter].

3. The ppm values should be stored in one library. Another library should be kept clear to enable the recording of detector response values. This allows manual calculation of sample concentrations for compounds misidentified by the Photovac.
4. Single-point calibrations must be repeated when retention times drift significantly or when detector signal response changes. Several recalibrations may be necessary when the Photovac is subjected to wide ambient temperature changes. Maintaining a constant temperature environment, if possible, reduces the need for recalibration.

5. At a minimum, single-point calibrations should be performed at the beginning and end of the analysis session.

B. Multiple Point Calibrations

1. This method can increase the accuracy of the calculated sample values, however, it can be a time-consuming process. Normally, three or more standard concentrations are used. The procedure is as follows:

   a. Obtain a range of calibration standards that extends above and below the expected sample concentrations.

   b. Perform a separate calibration run for each standard level.

   c. Record the detector signal responses for each concentration level for all calibration compounds.

   d. A standard curve can be obtained by regressing the signal response against a calibration compound concentration using a suitable computer graphing or statistics program.

   e. IMPORTANT: Gain setting and injection volume differences between runs (if any) must be accounted for by multiplying the signal response by the appropriate ratios. Failure to do this will result in an erroneous regression equation.

2. Standard ppm concentrations need not be input into the Photovac for multiple-point calibrations. Compound names may be input for peak identification, however, it is often best to manually identify peaks.

3. The continued validity of the calibration curve should be assessed by running single point calibration standards at regular intervals between sample analyses and whenever detector signal drift is suspected. The full calibration procedure should be repeated whenever this check standard falls outside of an acceptable range (usually 10%).

6.4.3 Follow instructions in reference 3.2, Section 6.2 “Process for Handling Calibration Deficiencies,” if calibration problems are experienced.

6.5 Sample Analysis

A. Gas and vapor samples may be analyzed by the following procedure:

1. Adjust the gain to an appropriate setting by hitting the [gain] key, then hit the arrow up or down key to change the value. Hit [enter] to set the displayed value.

   • Low-gain settings such as 2, are used for high-concentration samples, while lower-level samples should be analyzed at a higher gain.

2. Input desired information such as sample ID, injection volume, etc. by hitting the [info] key and using the alpha-numerical characters on the Photovac keypad.

   • Up to three lines of information may be entered which can be printed with the results. This information may also be entered during the sample analysis run.

3. Obtain an appropriate volume of sample using a syringe.
   - Normally, injection volumes of 100 µL are used. For syringe injections, the volume should not exceed 1 mL.
4. Quickly insert the syringe needle into injection port #1 on the Photovac but not through the septum.
5. Press the [start/stop] and [enter] buttons on the Photovac keypad.
6. After 8 seconds, a buzzing sound will be emitted for a duration of 2 seconds. When the buzz stops, push the needle through the septum and depress the syringe plunger. Allow approximately 2 seconds for the sample to enter the column then pull the needle out of the injection port. Consistency of injection style is a key to obtaining accurate results.
   - IMPORTANT: Care should be exercised to avoid injecting significant amounts of water vapor into the Photovac, since this will affect detector performance. *Under no circumstances should any liquid be injected.*
7. Flush the syringe after use with zero air using the port installed on the tank regulator. Follow QA procedures before reusing the syringe.
8. After all the compounds of interest have eluded, hit the [start/stop] button to end the run, or wait for the Photovac to reach the set analysis time which causes the run to automatically stop.
9. If the single-point calibration method is being used, print the results in ppm and volt-seconds. This is accomplished by changing libraries after the initial results are printed then hitting [cal] [enter]. This is useful for data analysis purposes.
10. Inspect the resultant chromatogram to ensure proper peak integration, identification, etc. This should be done prior to the next analysis, since the Photovac only stores results from the most recent analysis. Starting the next run erases and overwrites the previous data.

6.6 Shut Down

6.6.1 Hit the [off] then [enter] keys.

6.6.2 Turn the oven temperature set knob to off.

6.6.3 Close the carrier gas-supply tank valve.

6.6.4 Important: Do not leave the instrument on without carrier gas flow—column damage may occur from ozone accumulation.

6.7 Sample Collection

The procedure for sample collection will depend entirely on the specific test being performed. Gas and vapor samples may be obtained directly from the source using a syringe or collected in a suitable container prior to analysis. This section overviews just a few possible sample collection techniques.

6.7.1 Direct

Samples may be obtained directly from the source with a syringe. A vacuum pump is used to draw a stream of sample gas from the sample point. A segment of silicone tubing or a septum port is installed along the sample point to vacuum pump plumbing. This process enables a gas sample to be collected by a syringe after a suitable line purge volume has passed. Samples are then immediately injected into the Photovac for analysis. A rechargeable portable vacuum pump is available for remote operations.

6.7.2 Containers

Prior to analysis, samples may be collected in various holding containers. Container types include tedlar bags, stainless steel canisters, Mylar bags, etc. Containers should be tested for absorptive tendencies prior to their selection for use. A vacuum pump may be used to draw samples directly into canisters with ridged walls, while a desiccator can be modified to allow sample collection in tedlar bags.

6.7.3 All sample collection containers should be connected upstream from the sample pump to avoid carry-over contamination from the pump. While collecting a sample, the container should be purged first with the sample gas to ensure a representative aliquot is obtained.

6.7.4 IMPORTANT: Care should be exercised to avoid collecting significant amounts of water vapor along with the sample. *Under no circumstances should any liquid be injected into the Photovac.*

6.8 Data Analysis

6.8.1 Chromatogram Inspection

Chromatograms should be inspected for off-scale peaks, misidentified compounds, and improper peak integration.

A. Chromatographic peaks which are significantly off scale (flat tops) may include more than one compound, therefore, the sample should be reanalyzed at a lower gain or injection volume.

B. Misidentified peaks occur when significant retention time drift has occurred since the last calibration run. Concentrations of the actual compound (but listed as unknown) can be manually calculated and is discussed in Section 6.8.2, “Quantification.”

C. Improper integration occurs when broad or irregular shaped peaks emerge from the column. These samples must be re-analyzed.

6.8.2 Quantification

A. Concentration results will automatically be printed by the Photovac if the single-point calibration method is used and the calibration standard concentrations have been stored in the present library being used.

B. Multiple-point calibrations require sample concentrations to be determined by using a regression equation obtained by statistical analysis of the calibration response factors and concentrations. The sample’s response factor must be adjusted for gain setting and injection volume differences by multiplying the factor by the appropriate calibration to sample value ratio.

C. It may be necessary to manually calculate values for misidentified compounds. This can be accomplished by using the volt-second response and the following formula:

$$C_S = (C_C/V_C) * (V_S) * (G_C/G_S) * (I_C/I_S)$$

where:

Cs = concentration of the sample

Cc = concentration of the calibrant

Vc = volt-second response of the calibrant

Vs = volt-second response of the sample

Gc = gain setting of the calibration run

Gs = gain setting of the sample run

Ic = injection volume of the calibration run

Is = injection volume of the sample run

6.9 Quality Assurance (QA)/Quality Control (QC)

6.9.1 The steps taken to ensure accurate and reliable data define the QA plan. The intensity of the plan should be tailored to the data quality objectives of the specific test being conducted. If the Photovac is being used for screening samples, a less rigorous program may be acceptable, while other uses may require performing more QA measures.

6.9.2 Syringe blanks should be analyzed frequently to identify contamination and assure reliable data. These blank runs are accomplished by collecting an aliquot of zero air from the valved port and analyzing it as a sample. Generally, flushing each syringe with zero air after use adequately removes contaminants. However, oven baking the syringes may be necessary when higher concentration samples are being analyzed.

6.9.3 Instrument blanks should be performed whenever contamination is suspected. Instrument blank runs are accomplished by simply starting an analysis but without making an injection. This contamination check is especially important when high concentration samples are being analyzed.

6.9.4 Calibration checks are necessary to assess the continued validity of the stored calibration file. Checks are performed whenever significant retention time drift or signal response change is suspected. If the check falls outside of an acceptable signal response range (usually 10%) or if previous runs contain several misidentified peaks, recalibration is necessary. This is performed simply by repeating the calibration procedure. This process updates the Photovac's calibration file and ensures that chemical compounds in the sample are being accurately identified and quantified.

6.9.5 Duplicates can be analyzed to determine the consistency of the data being produced. Duplicate runs are performed by simply repeating the analysis of a chosen sample.

6.9.6 Matrix spikes are analyzed to determine if the sample matrix is causing interference in the analysis. This becomes important when samples contain several compounds with similar retention times, which allows the possibility of peak overlap, and therefore, resulting in an over estimation of the sample's concentration.

A. The matrix spike process consists of injecting a sample with a standard of known concentration and analyzing the mixture. This procedure is more suited to samples that have been collected in a container prior to Photovac analysis.

B. The percent recovery is determined using the following equation:

$$R = 100 (S - U)/A$$

where:

R= recovery expressed as a percentage,

S= spiked sample's measured value,

U= unspiked sample's measured value, and

A= actual value of the spike alone.

6.9.7 Audit samples may be obtained from an outside source and analyzed to determine analytical accuracy.

6.9.8 Quality Assessment

A. The operator should check chromatograms immediately following each analysis to ensure they provide the necessary information. This should be followed up by a second review after tests have been completed and before results are reported. Since the Photovac identifies compounds solely by retention time, misidentified peaks are common.

B. Independent testing by another laboratory can be performed on duplicate samples to assess accuracy of the data. However, it is important to realize that variations in sample storage time, temperature, and pressure can create large differences in measured vapor concentrations. This assessment is more suited to samples that have been collected in a container.

6.10 Logbook

6.10.1 Individual chromatograms are removed from the Photovac plotter and taped into an official logbook. New logbooks are authorized by the Data Management Group (DMG).

6.10.2 Notes and calculations regarding specific analyses are written in the logbook along with the respective chromatograms. General comments and maintenance notes should also be entered into the book.

6.10.3 Logbooks are archived at the DMG reference library or at an established location by an approved custodian.

6.11 Reporting Results

After data interpretation, calculations, and review are completed, results are reported to the DMG.

6.12 Maintenance

6.12.1 Septum

The injection port septum requires periodic replacement. Generally, a new septum should be installed every 15 to 20 injections. This may vary depending on syringe needle type, diameter, and condition. Side-port needles are desirable, since they are less prone to plugging with pieces of cored septum and maximize septa life. Drastic and variable retention time drift often indicates the need for septum replacement.

6.12.2 Injection Port

After numerous injections, small pieces of torn septa tend to accumulate in the injection port and obstruct sample transfer. These obstructions can be cleared by first removing the injection port nut and septum and disconnecting the injection port tubing from the internal oven. Then, connect the high-pressure line within the Photovac housing to the injection port tubing for a few moments. This process will backflush pieces of septa out.

6.12.3 Syringes

Syringes should be cleaned between each use. Flushing zero air through the barrel works well but more contaminated syringes require oven baking of the glass and metal components. Teflon parts can be replaced if contamination persists. Avoid using cleaning solvents which may outgas and affect subsequent analyses. Worn syringe barrels or plungers will cause sample loss through leakage, therefore, all syringes should be inspected before use. Worn syringe barrels should be discarded. When the syringe plungers slide too easily, replace the Teflon tips.

6.12.4 Plotter Pens

Spent plotter pens require replacement. Replacement pens can be obtained through local electronic supply stores at a nominal cost or by ordering from Photovac International, Inc.

6.12.5 Troubleshooting

For less frequent maintenance and instrument problems, consult the Photovac manual or call Photovac International, Inc. customer assistance.

6.12.6 Handling and Storage

The Photovac unit is housed in a protective aluminum case. However, it is sensitive to shock and should be handled with extreme care. The instrument should be kept clean and away from excessive dust or dirt. The instrument and its accessory equipment should be stored in a cool, dry and clean environment when not in use.

6.13 Miscellaneous

6.13.1 Detector

The Photovac's factory installed detector is a 10.6 eV photoionization lamp. This detector is suitable for most analytical purposes. Some compounds with higher ionization potentials require a higher energy lamp to show a significant and detectable response. For these cases, the 11.7 eV lamp may be installed. However, this detector is subject to several limitations including sensitivity reduction when exposed to water vapor. Consult the Photovac manual for specific information.

6.13.2 Carrier Gas

A. The Photovac requires purified air as a carrier gas. Various grades of gas are acceptable but they should be <0.1 ppm in total hydrocarbons. Higher levels of purity allow lower detection limits but can be expensive, therefore, the specific analytical needs and budgetary limitations will dictate carrier grade requirements. Zero air has shown to be acceptable for most uses and is available on site from Industrial Gases.

B. The carrier gas can be supplied to the Photovac column by an external tank connection or the internal reservoir. For most cases, the external connection is preferred since larger tank sizes may be used. External sources require a two-stage regulator to step delivery pressure down to 40 psi. The internal storage canister is useful for remote operation, however, its limited capacity necessitates frequent refilling.

6.13.3 Software

The Photovac may be remotely controlled using the Dandi software package and an IBM compatible computer. Use of this software program enables the operator to perform additional functions not accessible using the Photovac alone. These functions include data storage, chromatogram refinement, as well as other data reduction capabilities. The software also enables the operator to control the instrument from distant locations over a telephone line while using a modem. However, this capability is generally more useful while operating in the auto-injection mode, since manual injections require the presence of the operator.

7.0 QA RECORDS

7.1 Completed logbook

7.2 Completed Quality Improvement Form

7.3 Standard Certification Certificates/Documentation

7.4 Analytical Results Report

8.0 ATTACHMENTS

Attachment A—Supply list

Attachment B—Photovac—Front Panel

Attachment C—Chromatogram Examples

Attachment A

Photovac Supply List

Photovac Supply List

Gas Chromatograph

____ Photovac 10S70

____ AC power cord

____ AC power-surge suppresser

____ 12V AC-DC converter

____ Two Cole Palmer flow meters

____ Zero air tank and regulator

____ Internal reservoir filling hose

____ Photovac operating manual

____ 6 mm replacement septa

____ Plotter pens

____ Printer paper roles

____ Detector lamps: 10.6 eV, 11.7 eV

Syringes

____ 500 µL, 100 µL, 10 µL with open-close slide valves

____ Sideport needles

____ Replacement Teflon plunger tips

____ Cleaning kit

Standards

____ BETX—1,10,50 ppm

____ TCE 10 ppm

____ Tank-pressure regulators

Miscellaneous

____ Tedlar bags

____ Portable vacuum pump

____ IBM computer, monitor, printer

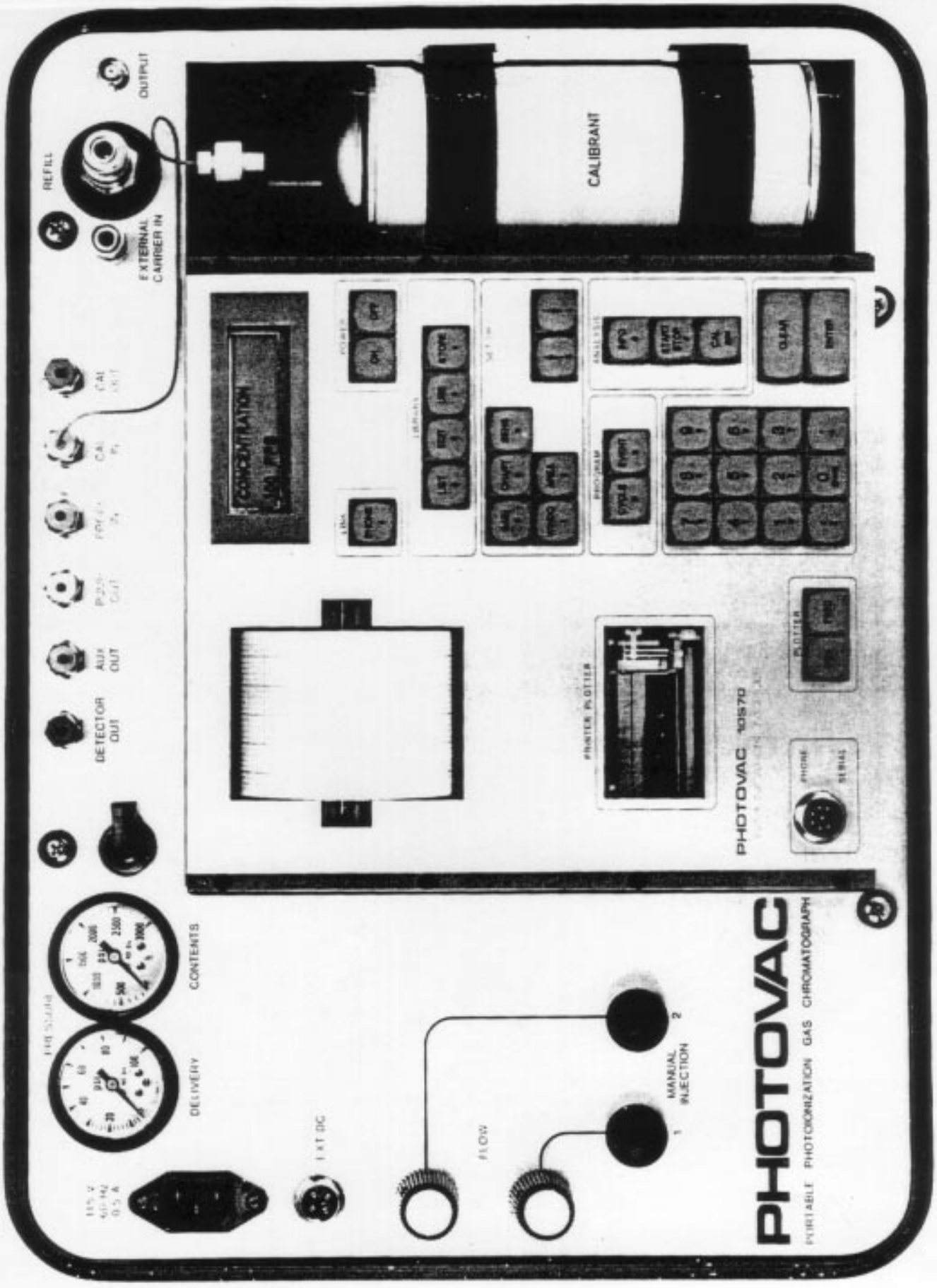
____ PC Dandi software

____ Phone/serial communication cable

____ Tool box with tools

Attachment B

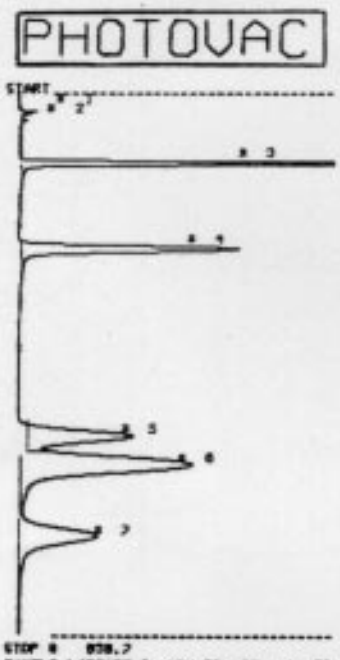
(Photovac—Front Panel)


PHOTOVAC
PORTABLE PHOTOIONIZATION GAS CHROMATOGRAPH
PHOTOVAC 10S70
CALIBRANT
REFILL
OUTPUT
EXTERNAL CARRIER IN
DETECTOR OUT
AUX OUT
CAL OUT
MANUAL INJECTION
FLOW
DELIVERY
CONTENTS

Attachment C

Chromatogram Examples (BETX Calibration Run— Typical Gasoline Sample)

BETX Calibration run



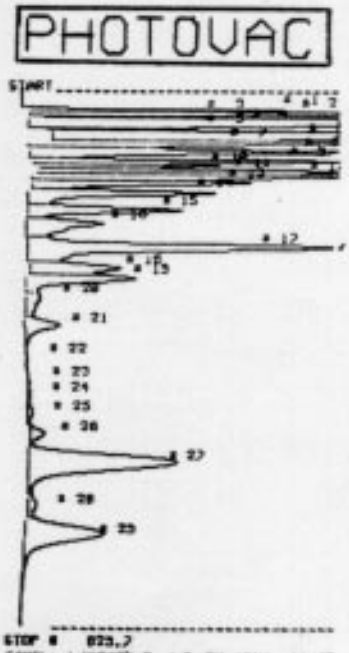
STOP # 838.7
SAMPLE LIBRARY 2 NOV 28 1991 11:22
ANALYSIS # 38 CAL:38 28 FFM
INTERNAL TEMP 34 100 UL
GAIN 2 P GAUFIELD

COMPOUND NAME	PEAK	R.T.	AREA/FFM
UNKNOWN	1	38.3	46.1 uVS
UNKNOWN	2	42.3	21.3 uVS
UNKNOWN	3	183.7	11.7 VS
UNKNOWN	4	246.3	8.2 VS
UNKNOWN	5	333.1	8.1 VS
UNKNOWN	6	384.1	17.1 VS
UNKNOWN	7	636.3	7.8 VS

SAMPLE LIBRARY 2 NOV 28 1991 11:23
ANALYSIS # 32 CAL:38 28 FFM
INTERNAL TEMP 34 100 UL
GAIN 2 P GAUFIELD

COMPOUND NAME	PEAK	R.T.	AREA/FFM
UNKNOWN	1	38.3	46.1 uVS
UNKNOWN	2	42.3	21.3 uVS
BENZENE	3	183.7	38.38 FFM
TOLUENE	4	246.3	38.38 FFM
ETHYL BENZENE	5	333.1	31.38 FFM
P,M-XYLENE	6	384.1	183.8 FFM
O-XYLENE	7	636.3	52.88 FFM

Typical Gasoline Sample



STOP # 823.7
SAMPLE LIBRARY 2 NOV 28 1991 11:43
ANALYSIS # 31 BGW-16-3,4,5
INTERNAL TEMP 33 102 UL
GAIN 2 P GAUFIELD

COMPOUND NAME	PEAK	R.T.	AREA/FFM
UNKNOWN	1	38.8	1.3 VS
UNKNOWN	2	55.1	2.4 VS
UNKNOWN	3	68.1	755.1 uVS
UNKNOWN	4	87.7	57.6 VS
UNKNOWN	5	81.5	1.7 VS
UNKNOWN	6	85.3	31.6 VS
UNKNOWN	7	75.8	3.3 VS
UNKNOWN	8	94.4	11.8 VS
BENZENE	9	103.6	24.43 FFM
UNKNOWN	10	117.1	3.3 VS
UNKNOWN	11	123.3	8.4 VS
UNKNOWN	12	132.8	8.1 VS
UNKNOWN	13	143.6	6.1 VS
UNKNOWN	14	160.1	8.4 VS
UNKNOWN	15	180.3	3.3 VS
UNKNOWN	16	200.3	4.2 VS
TOLUENE	17	246.7	87.31 FFM
UNKNOWN	18	278.3	4.2 VS
UNKNOWN	19	294.3	3.3 VS
UNKNOWN	20	323.1	1.5 VS
UNKNOWN	21	363.1	2.1 VS
UNKNOWN	22	454.8	131.8 uVS
UNKNOWN	24	478.8	271.3 uVS
UNKNOWN	25	505.8	464.5 uVS
ETHYL BENZENE	26	535.1	7.734 FFM
P,M-XYLENE	27	567.1	85.35 FFM
UNKNOWN	28	650.8	383.2 uVS
O-XYLENE	29	655.7	45.38 FFM